

LAPS Initialization of Models for Numerical Weather Prediction

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Modeling efforts related to HMT and simulations of MCSs

Collaborators: Zoltan Toth, Tim Schneider, Dan Birkenheuer, Allen White, Martin Ralph, Steve Koch, Steve Albers, Huiling Yuan, Ed Tollerud, Tara Jansen, John Halley Gateway

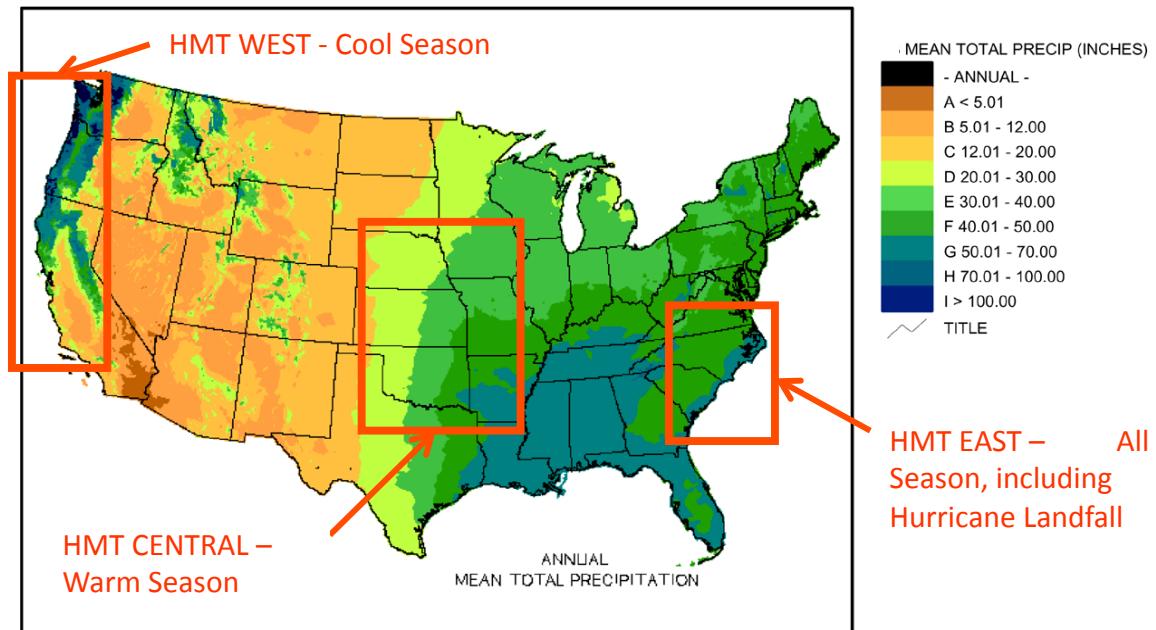
ESRL/PSD, NCAR/DTC, California DWR, NSSL, OHD, Western region WFOs and many others

LAPS workshop Boulder, CO
25-27 October, 2010

HMT Overview

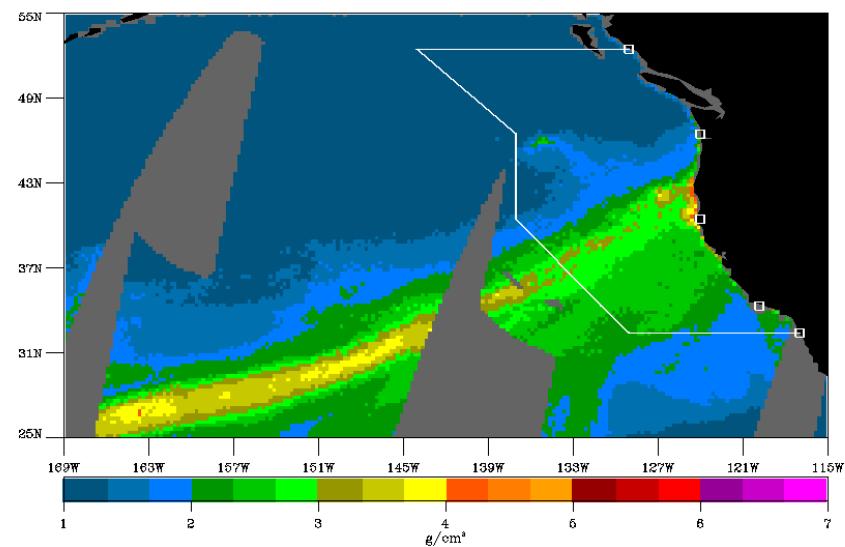
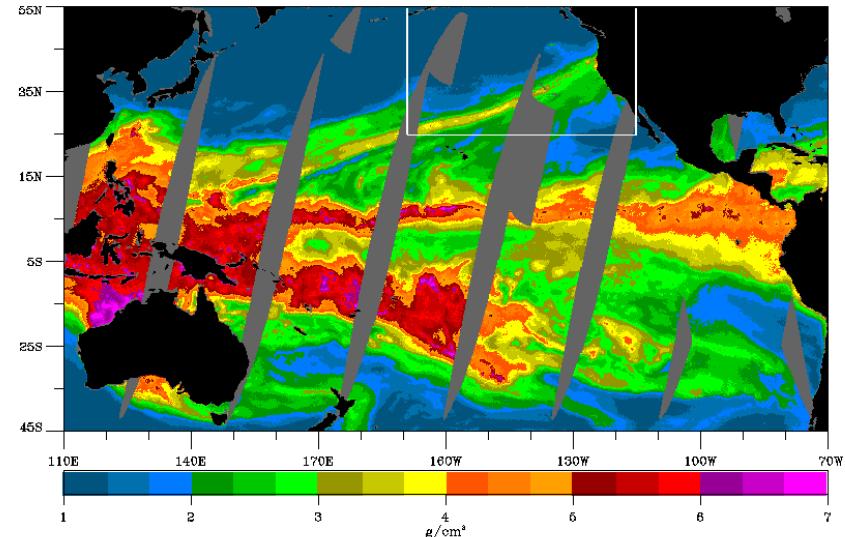
- ❖ Goal is to improve forecasts of rain and snow and associated hydrology
- ❖ Uses local-state-federal, and private-public-academic partnerships

Benefits: Accelerates improvements in QPF and flood forecasting, with impacts on transportation, ecosystems, emergency management, flood control and water supply. Science and field tests will advise on how best to fill gaps in observational and modeling systems.

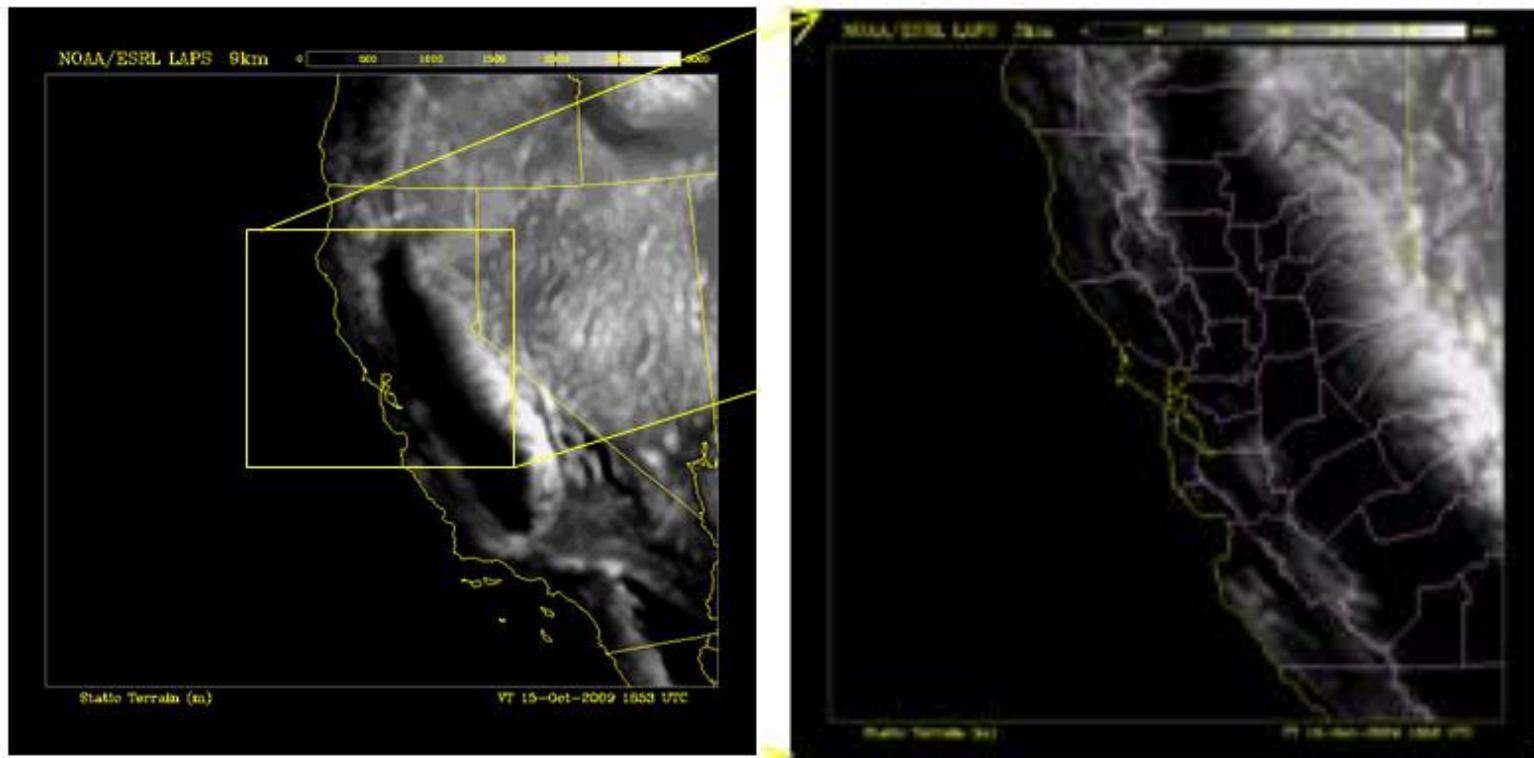


ATMOSPHERIC RIVERS

- o During the winter season significant precipitation events in California are often caused by land-falling “atmospheric rivers” associated with extra tropical cyclones in the Pacific.
- o Atmospheric rivers are elongated regions of high values of vertically integrated water vapor over the Pacific and Atlantic oceans that extend from the tropics and subtropics into the extratropics and are readily identifiable using SSM/I.
- o Due to the terrain steepness and soil characteristics in the area, a high risk of flooding and landslides is often associated with these events.



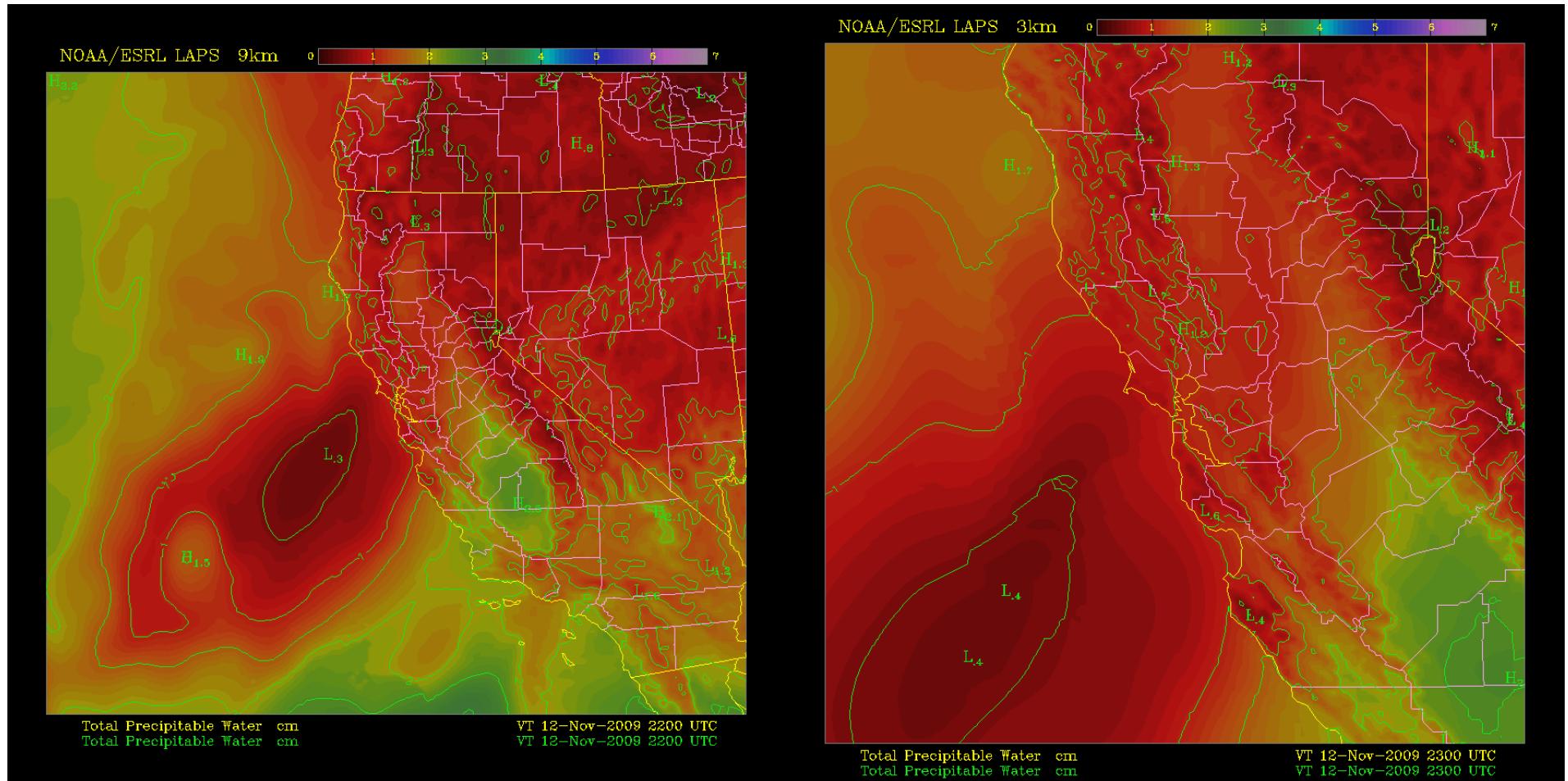
EXPERIMENT DESIGN 2009-2010



Nested domain:

- Outer/inner nest grid spacing 9 and 3 km, respectively.
- 6-h cycles, 120hr forecasts for the outer nest and 12hr forecasts for the inner nest
- 9 members (listed in the following slide)
- Mixed models, physics & perturbed boundary conditions from NCEP Global Ensemble
- 2010-2011 season everything stays the same except initial condition perturbations?

CORRESPONDING LAPS ANALYSIS FOR BOTH OUTER AND INNER NEST



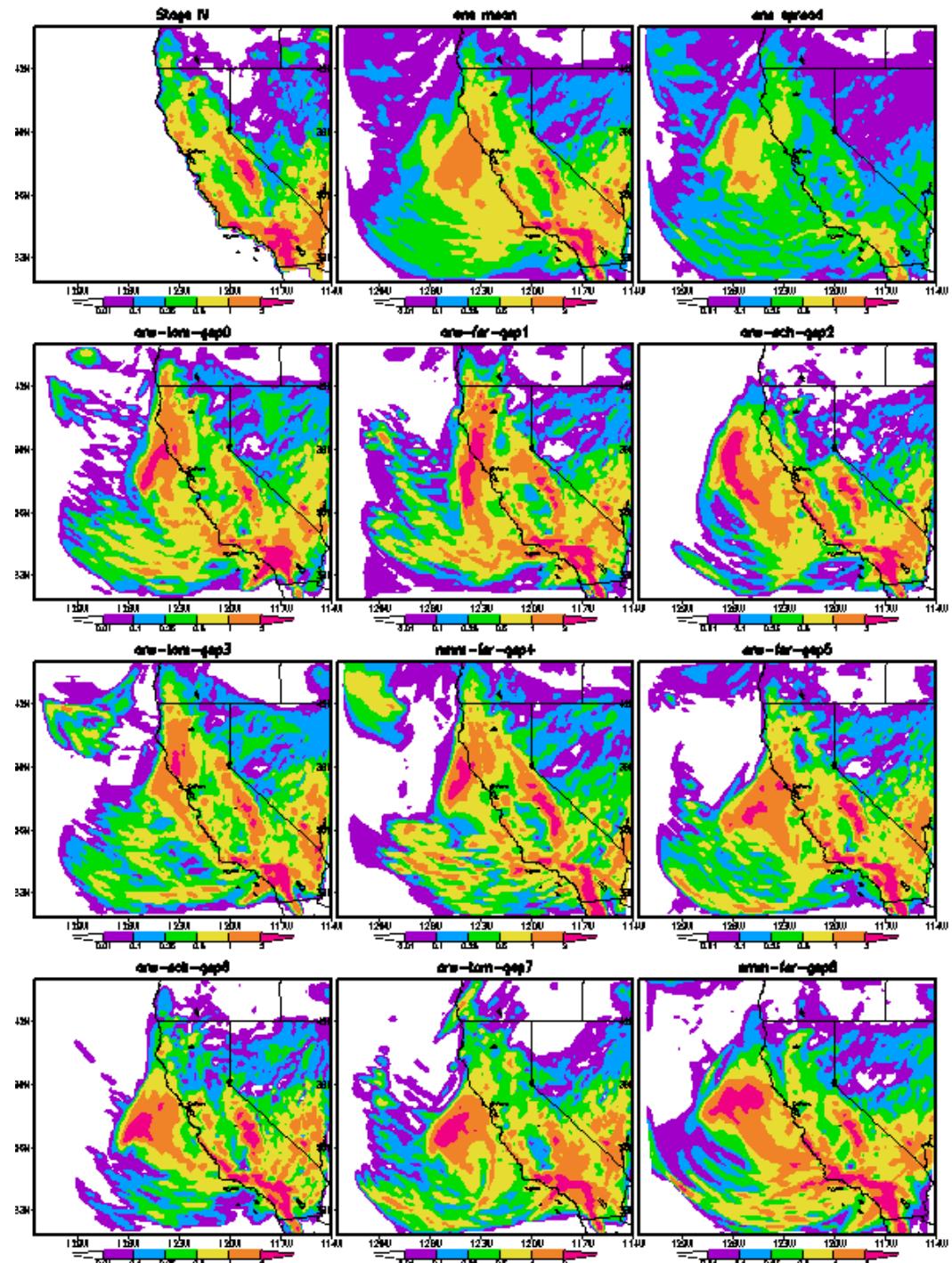
Total Precipitable Water analyses

QPF

Example of 24-h QPF
9-km resolution

9 members:

ARW-TOM-GEP0
ARW-FER-GEP1
ARW-SCH-GEP2
ARW-TOM-GEP3
NMM-FER-GEP4
ARW-FER-GEP5
ARW-SCH-GEP6
ARW-TOM-GEP7
NMM-FER-GEP8

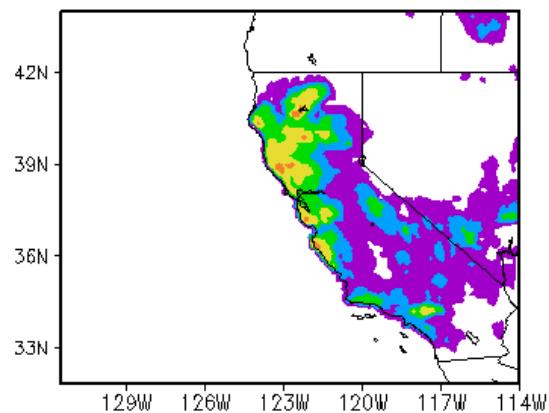


HMT QPF and PQPF

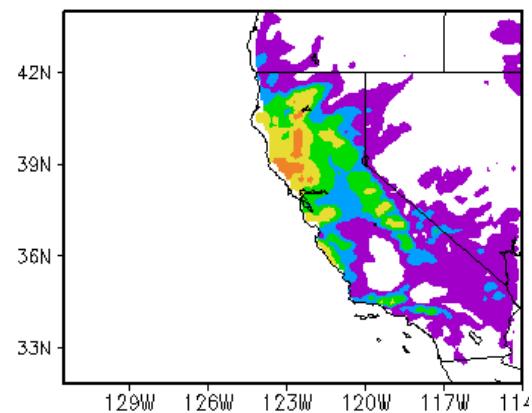
48-hr forecast starting at 12 UTC, 18 January 2010

0–6 h

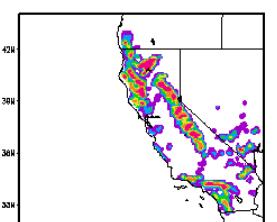
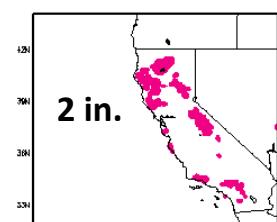
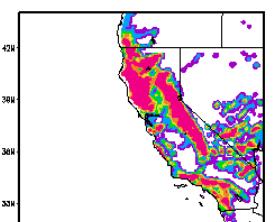
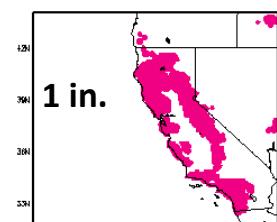
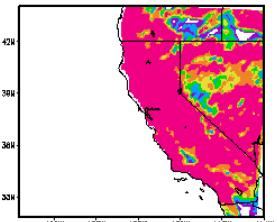
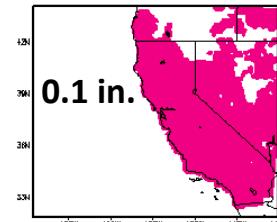
Stage IV



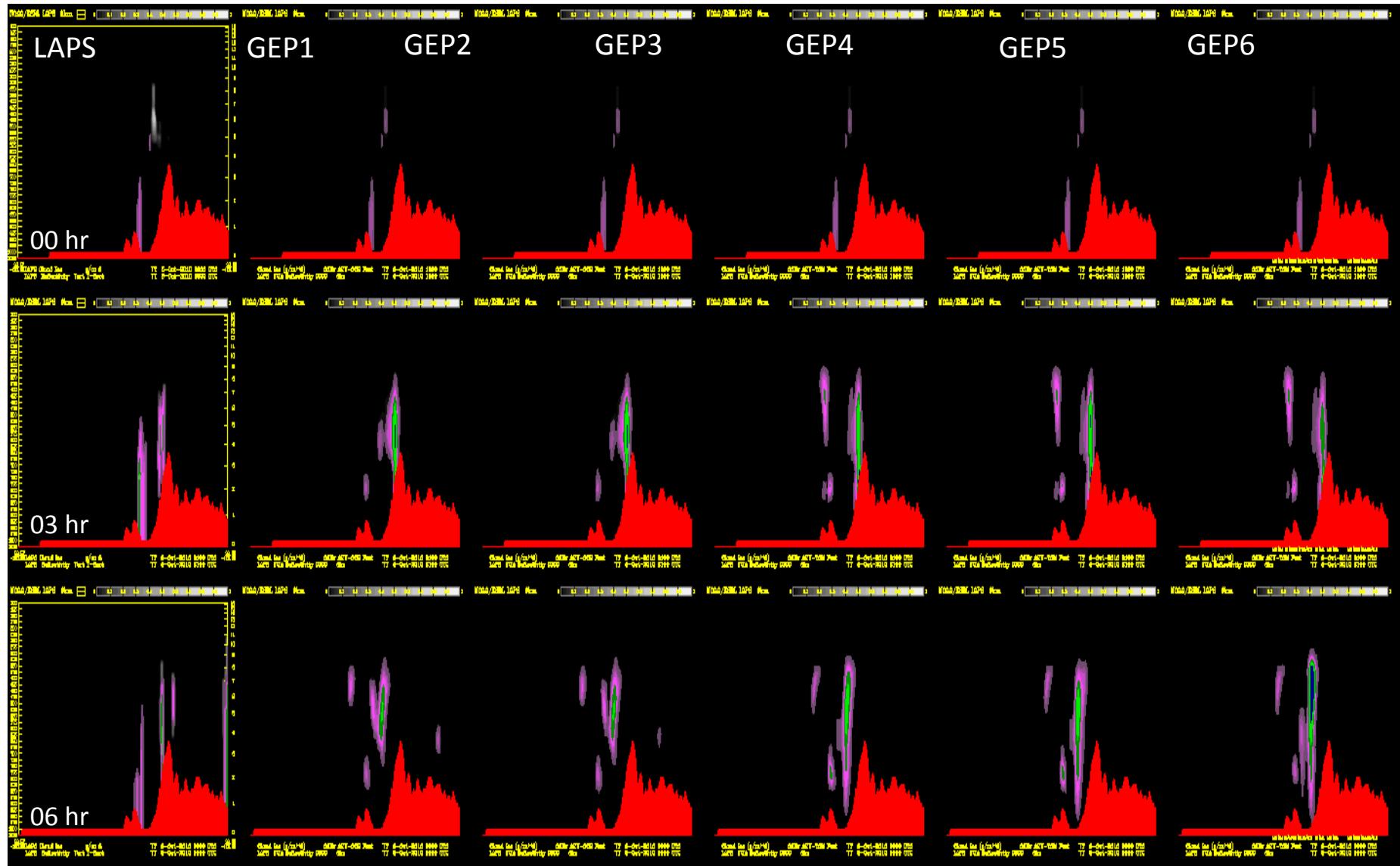
ensemble mean



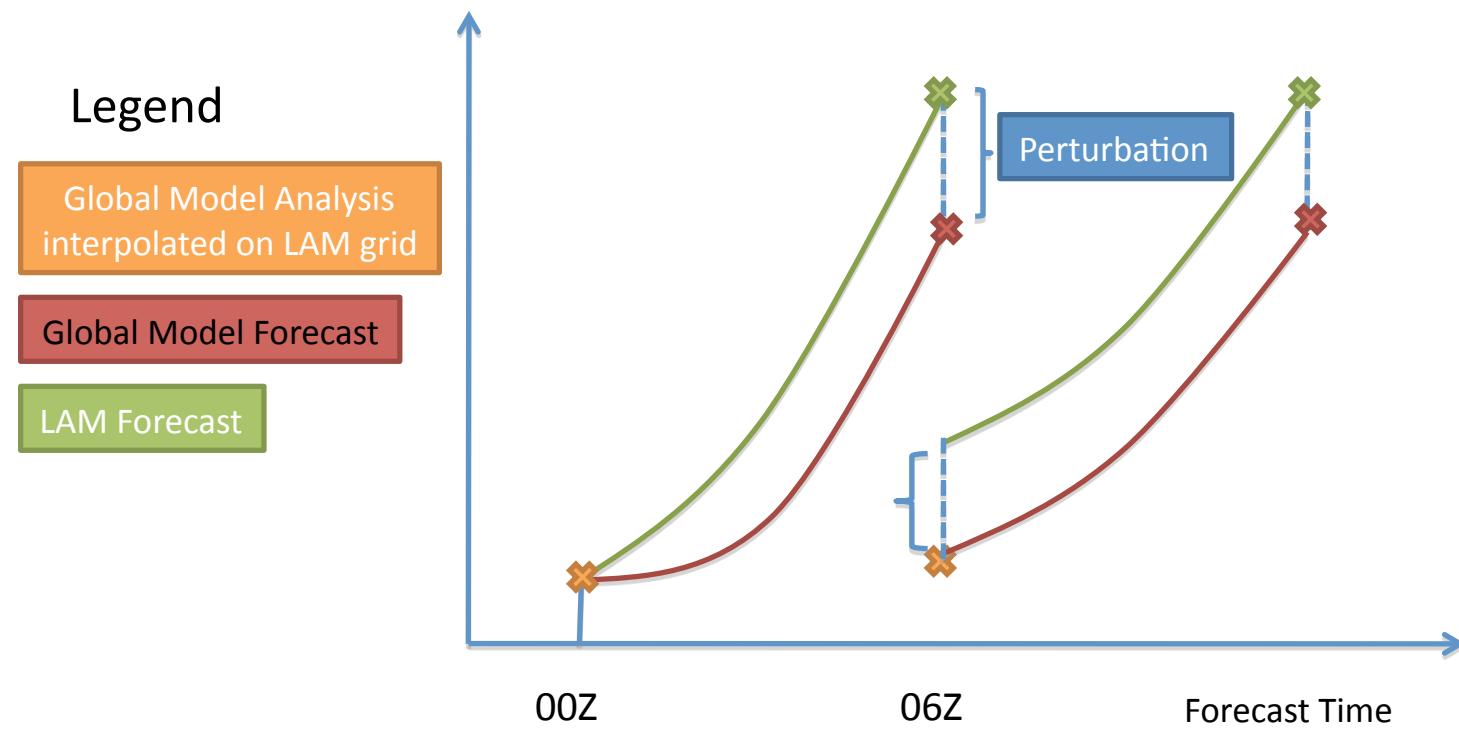
24-hr PQPF



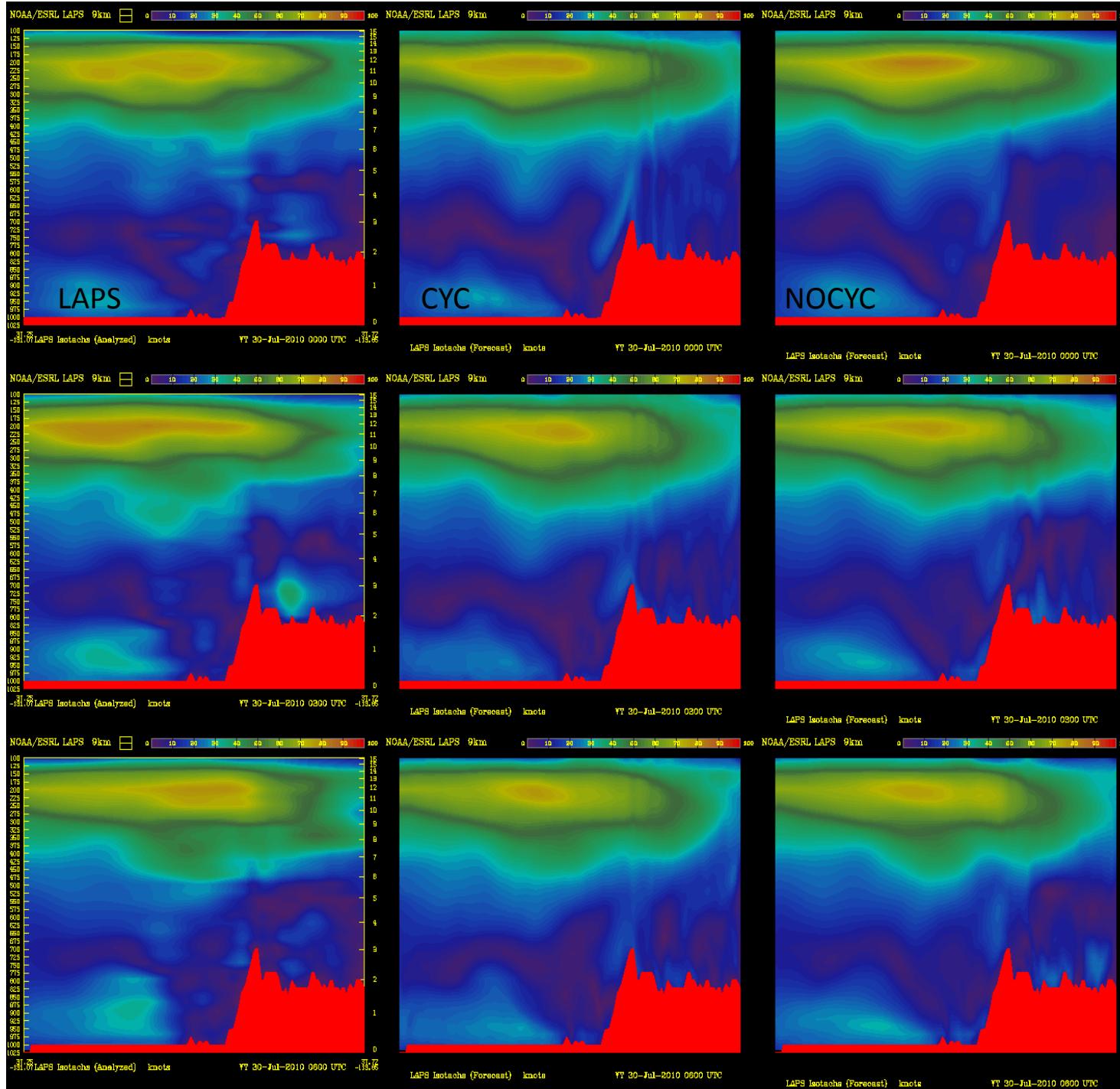
Xsect Reflectivity 06 Oct. 2010 18UTC



Cycling Initial Perturbations – Link with DET

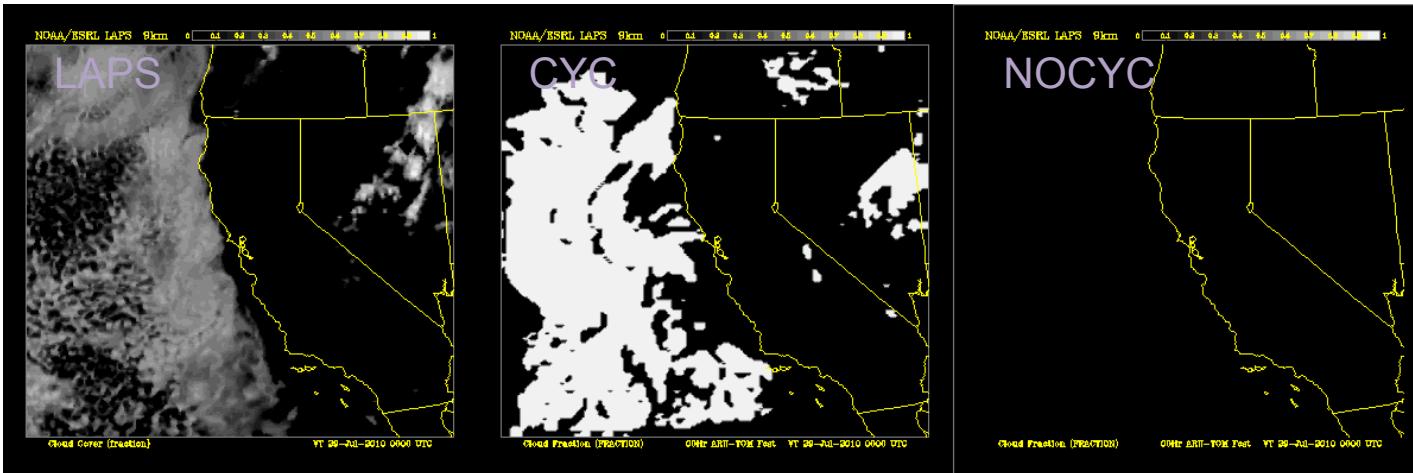


Wind Speed
July 30 2010 00UTC

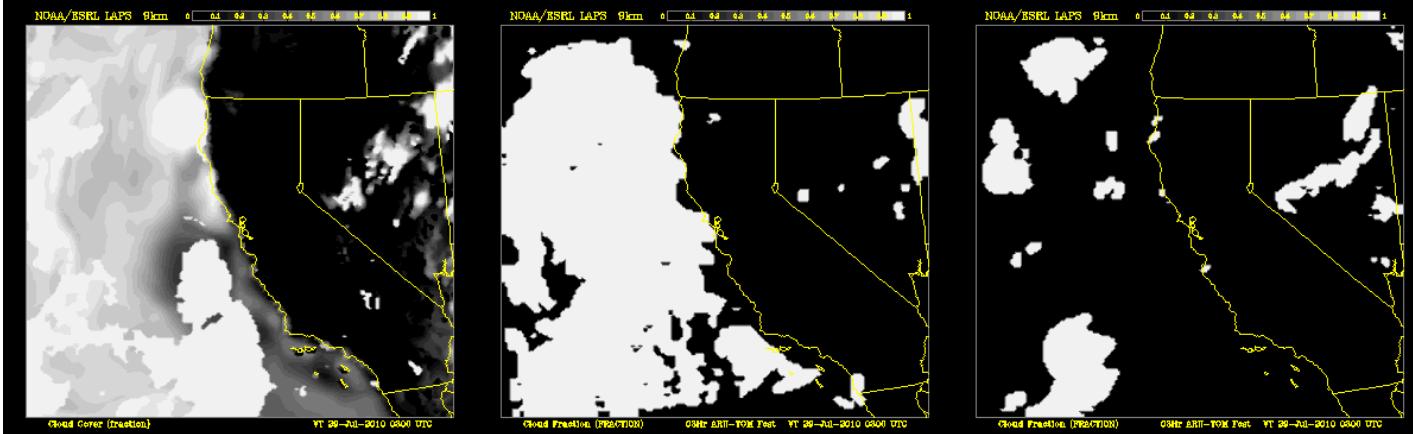


Cloud Coverage
July 30 2010 00UTC

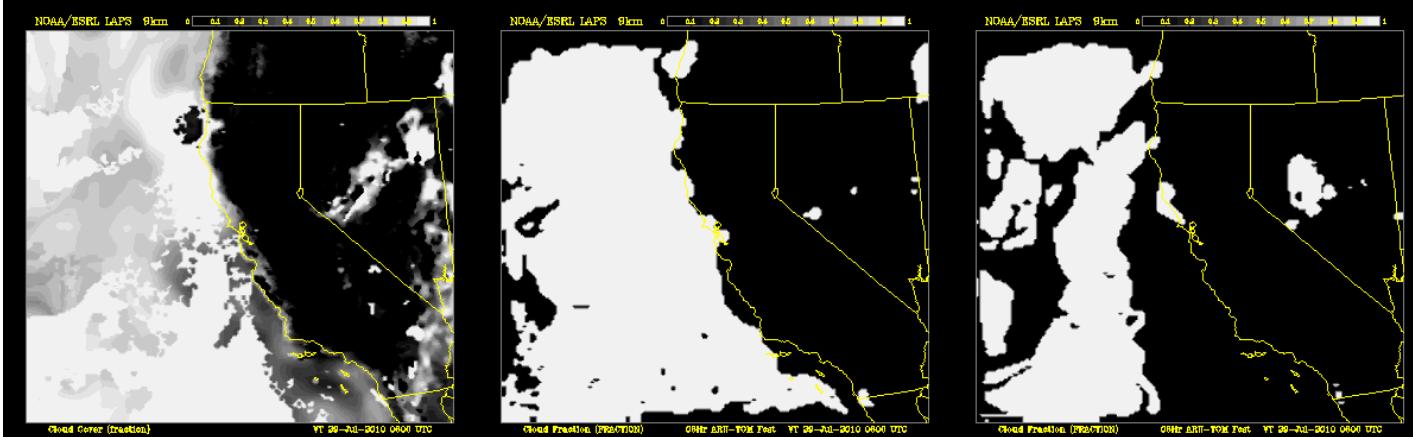
00hr



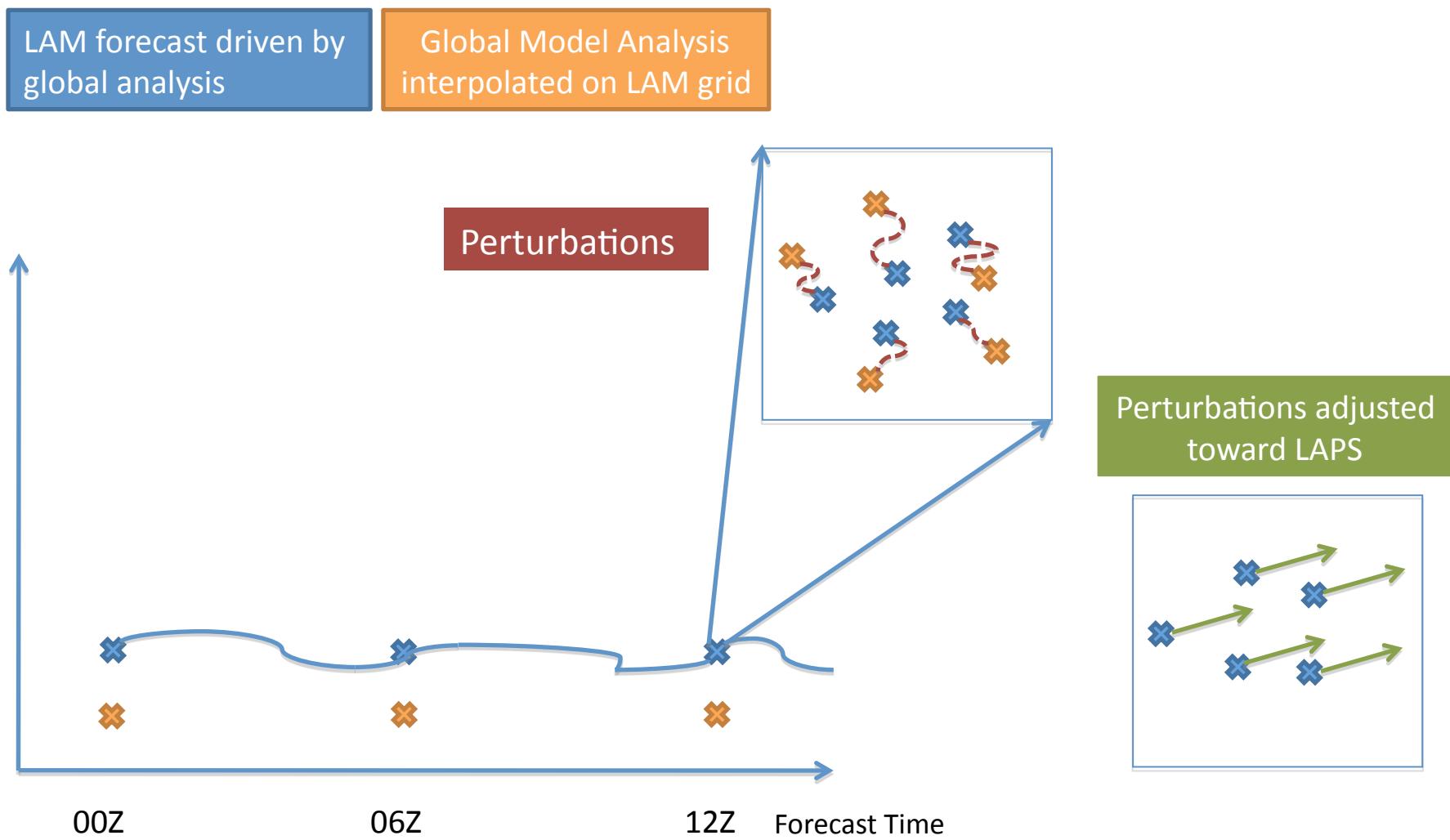
03hr



06hr

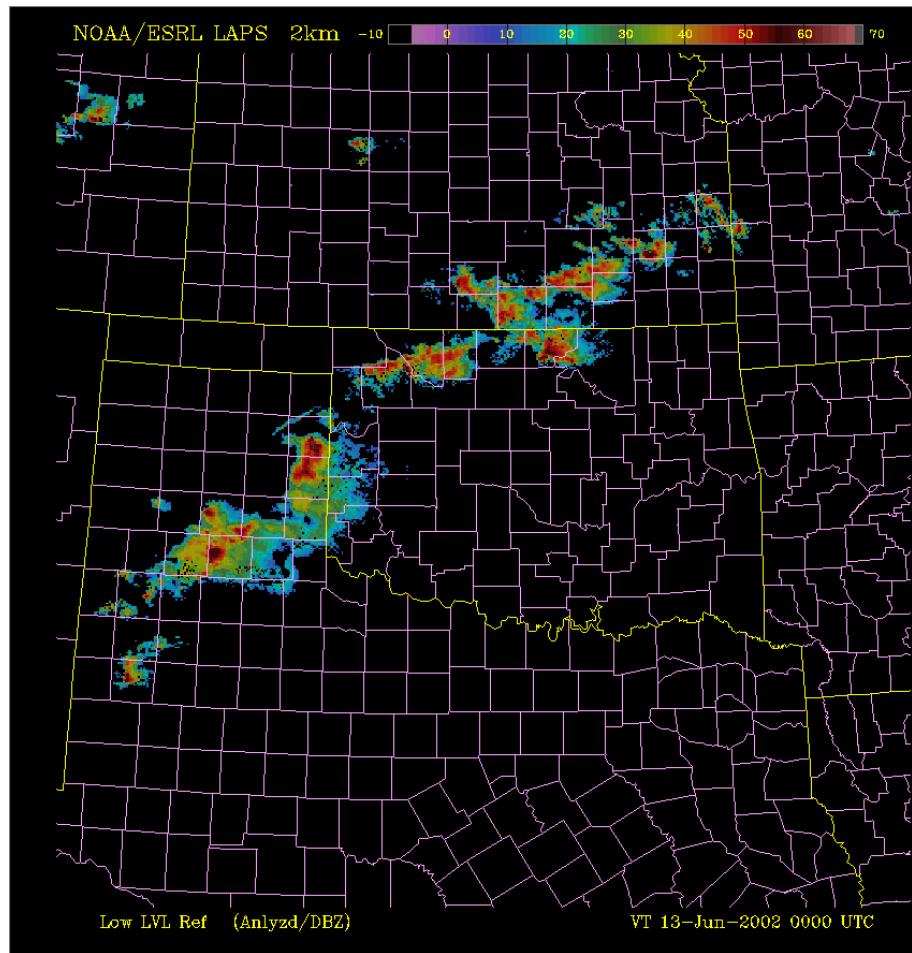


Initial Perturbations for HMT-10/11 “Cycling” GEFS (or SREF) perturbations

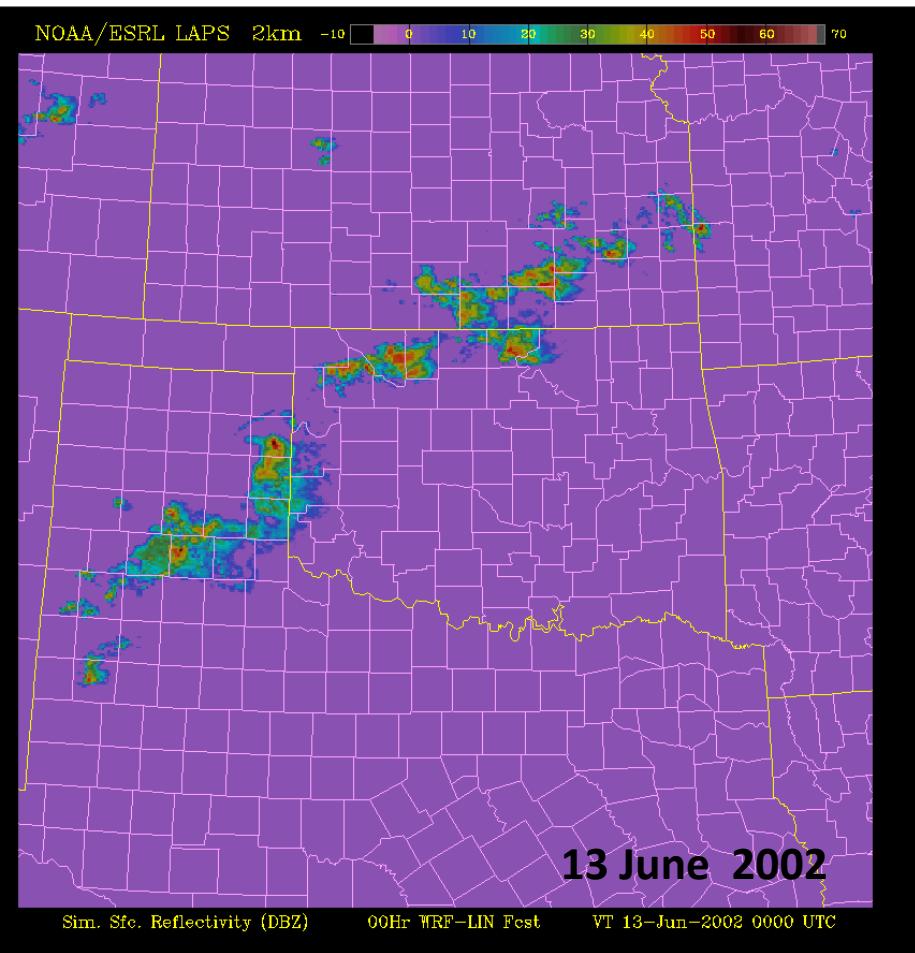


High resolution simulations of IHOP MCSs when
using LAPS hot-start initialization

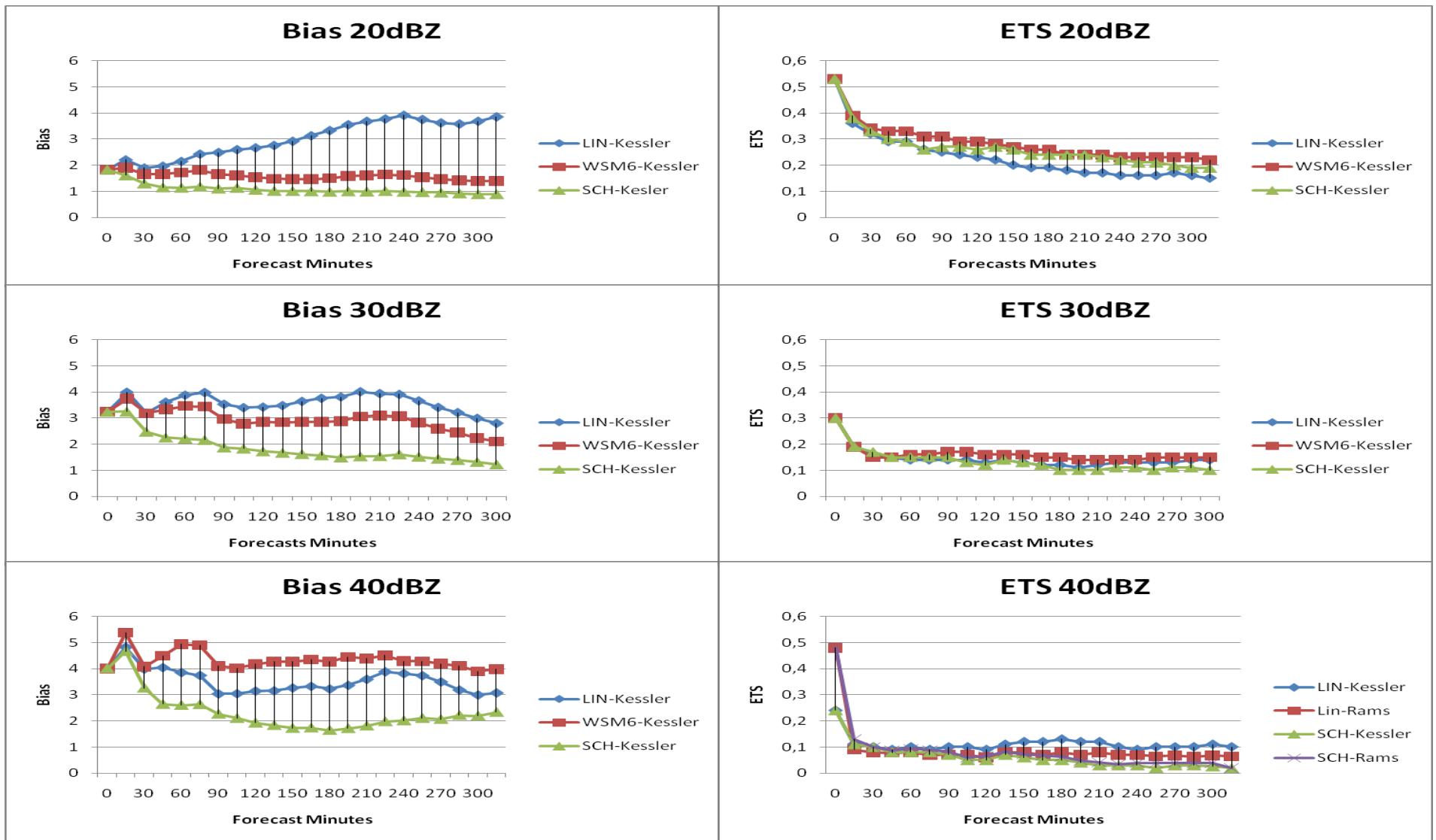
Analysis



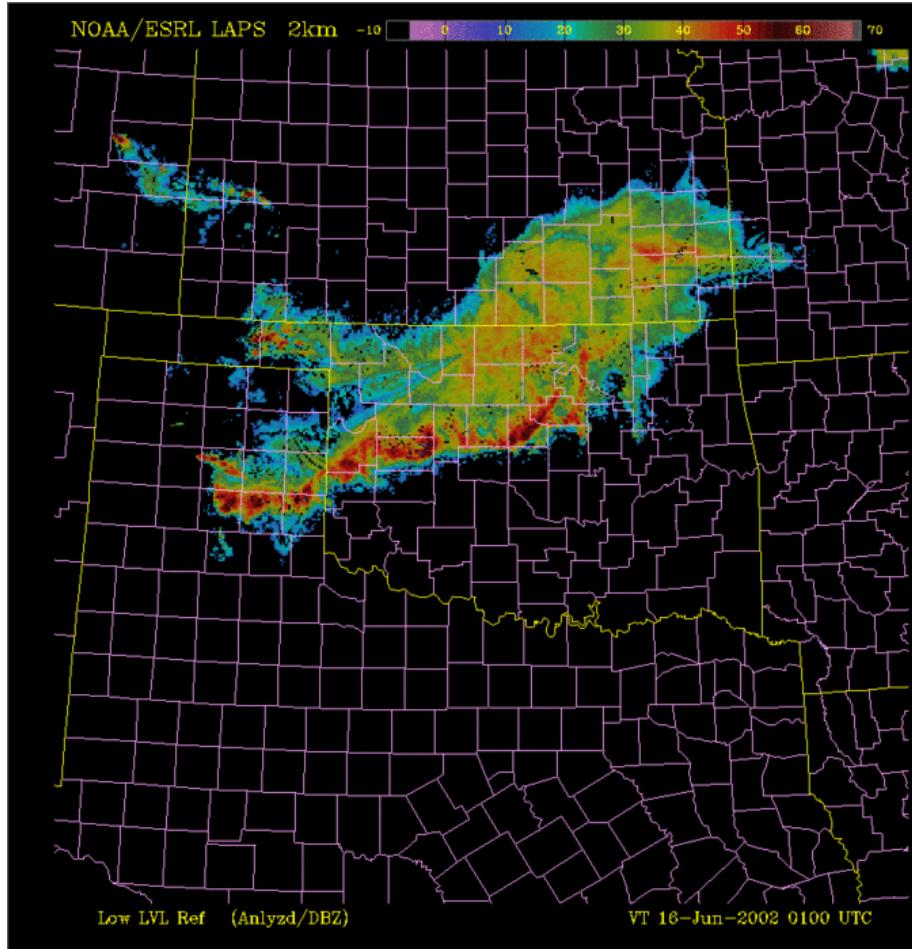
6-hr Diabatically (LAPS) initialized
WRF-ARW forecast



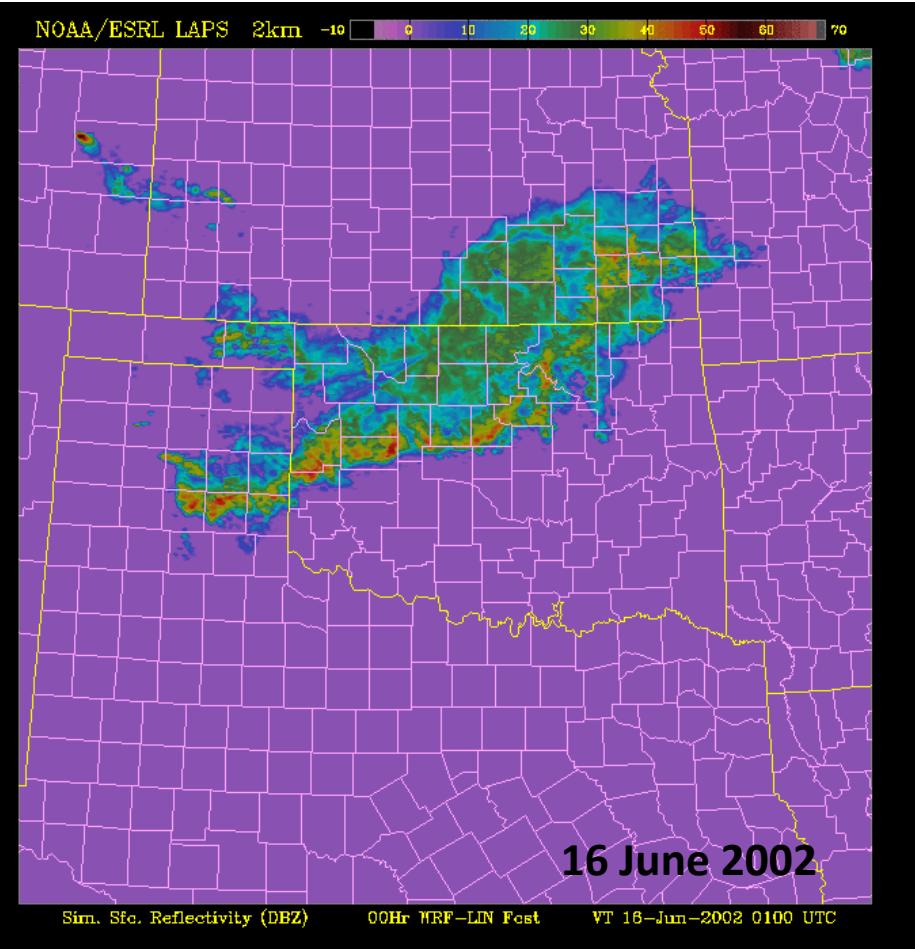
Bias & ETS June 13 2002



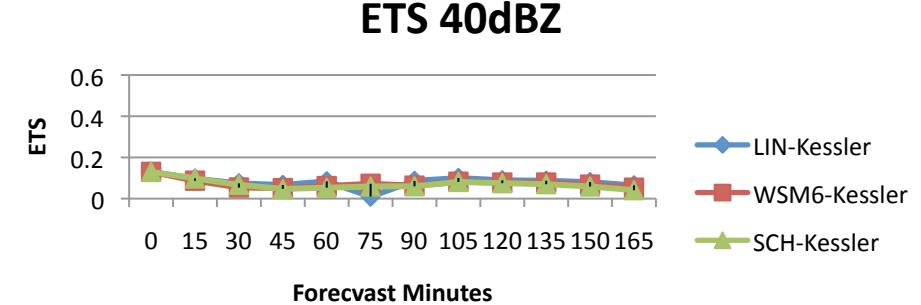
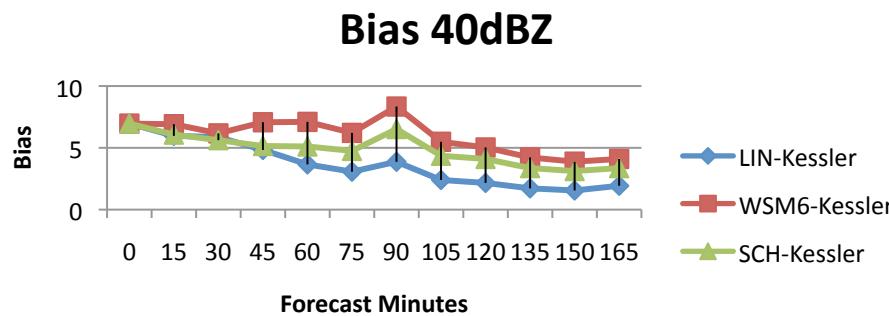
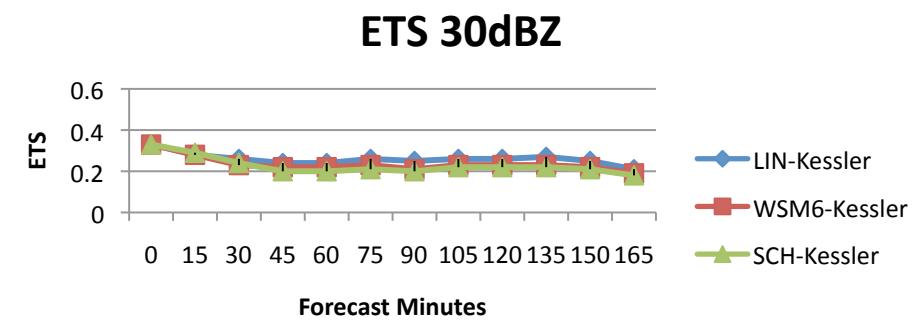
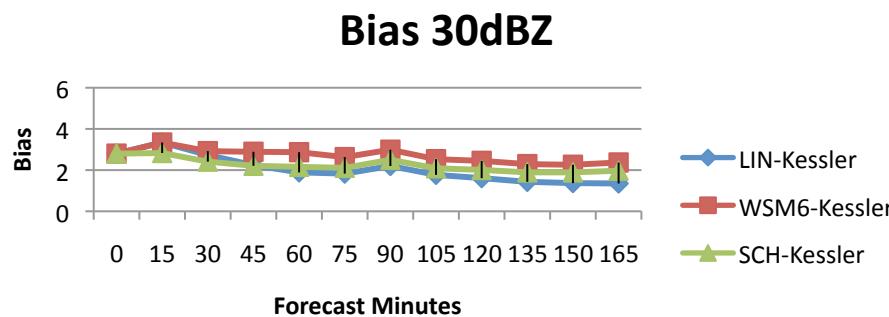
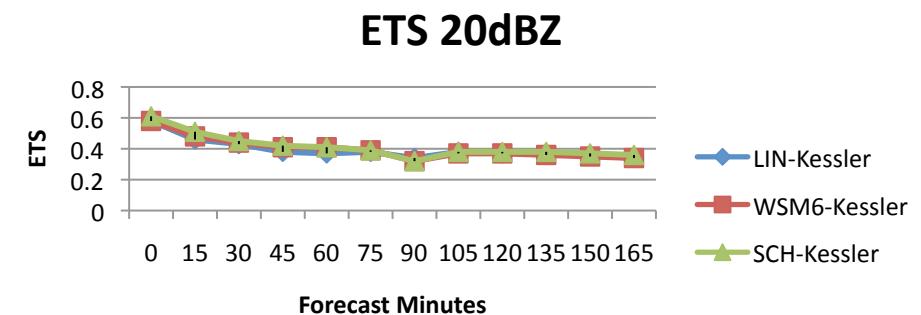
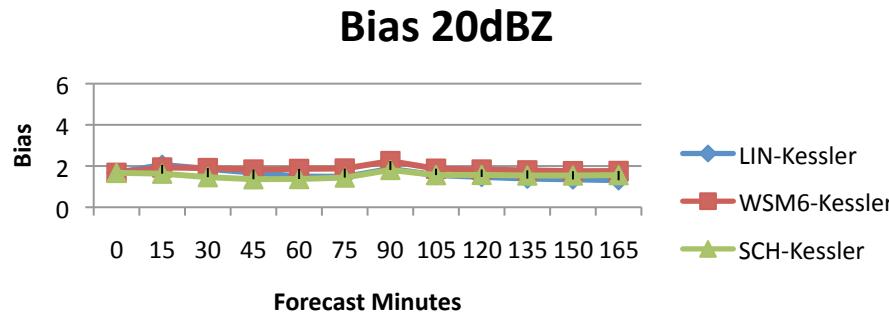
Analysis



3-hr Forecast

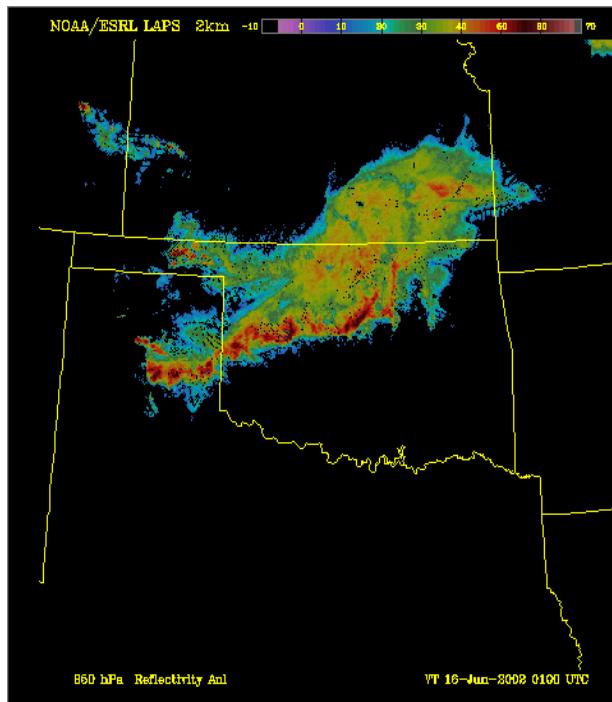


Bias & ETS June 16 2002

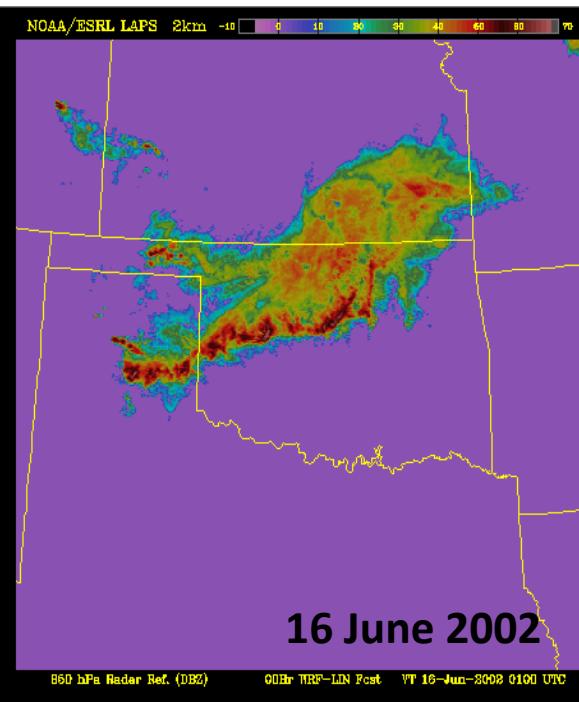


850 mb Analyzed and Simulated Reflectivity

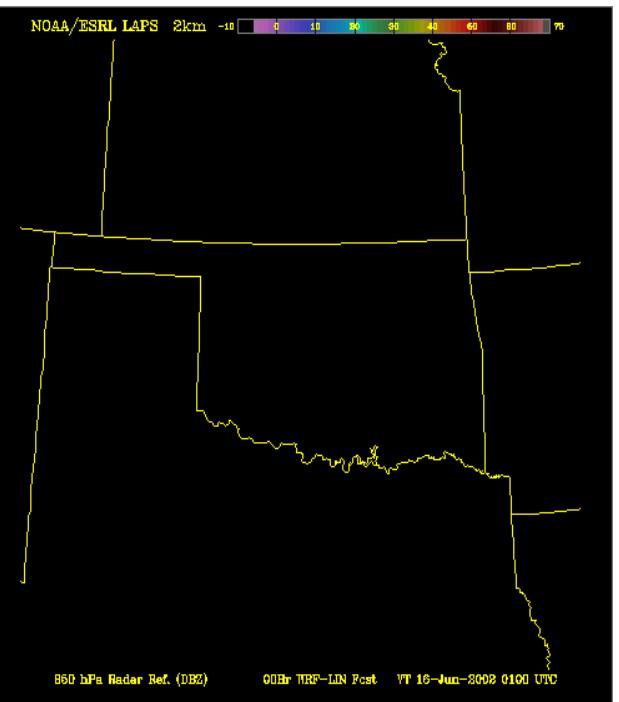
Analysis



2hr HOT Fcst



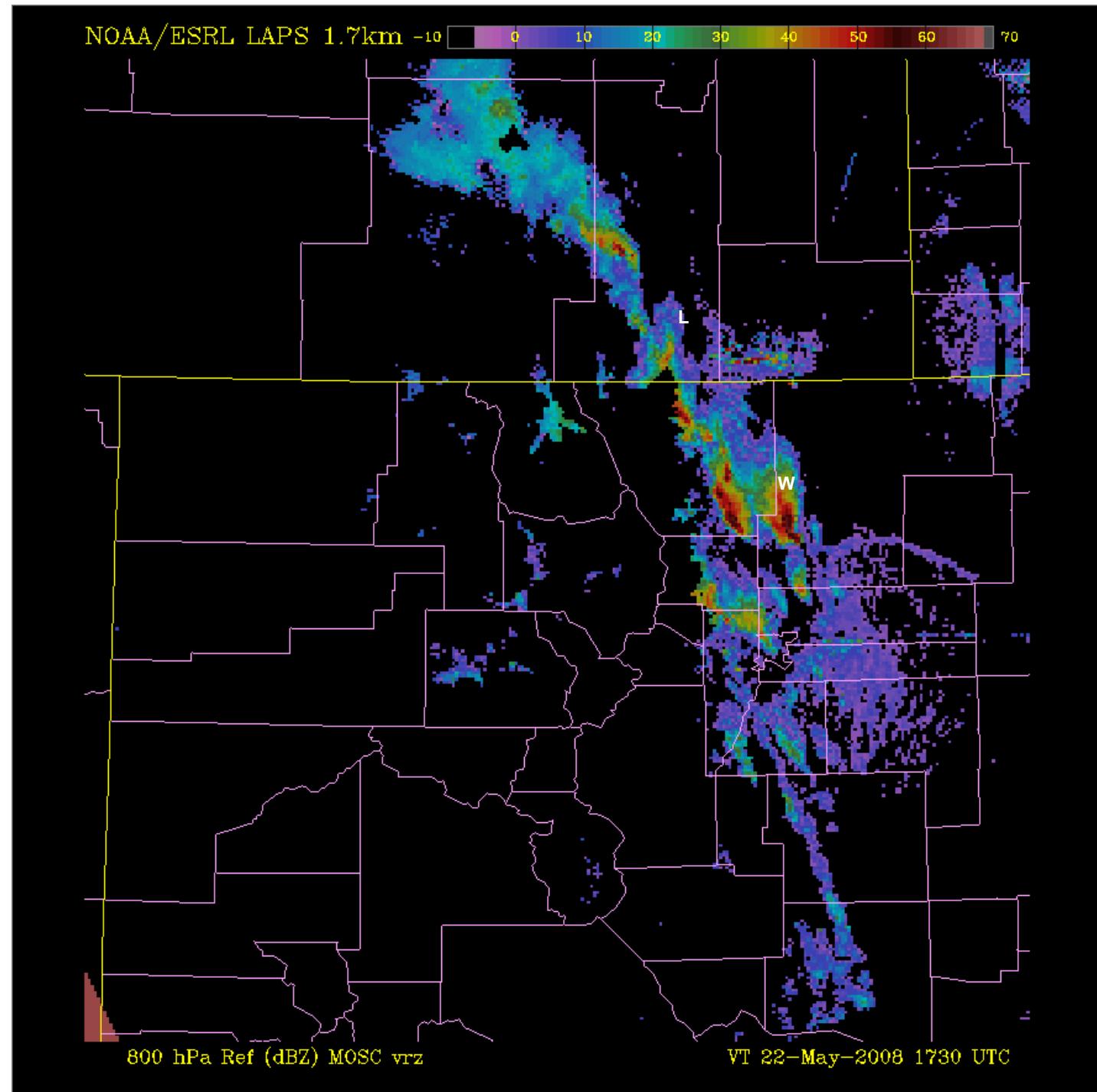
2hr NO-HOT Fcst



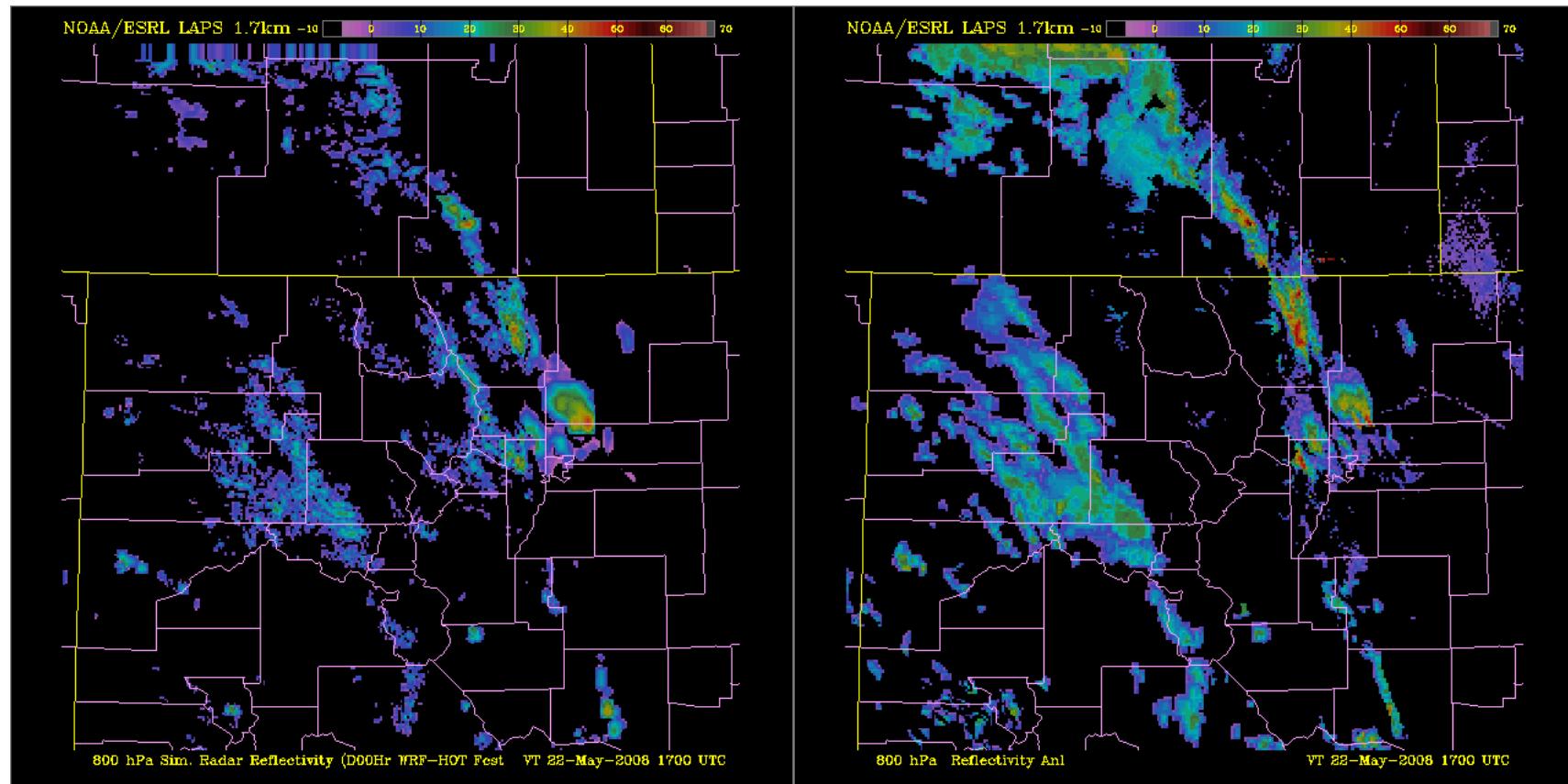
**800mb Radar
Reflectivity**

**W is Windsor
Tornado**

**L is Laramie
Tornado**

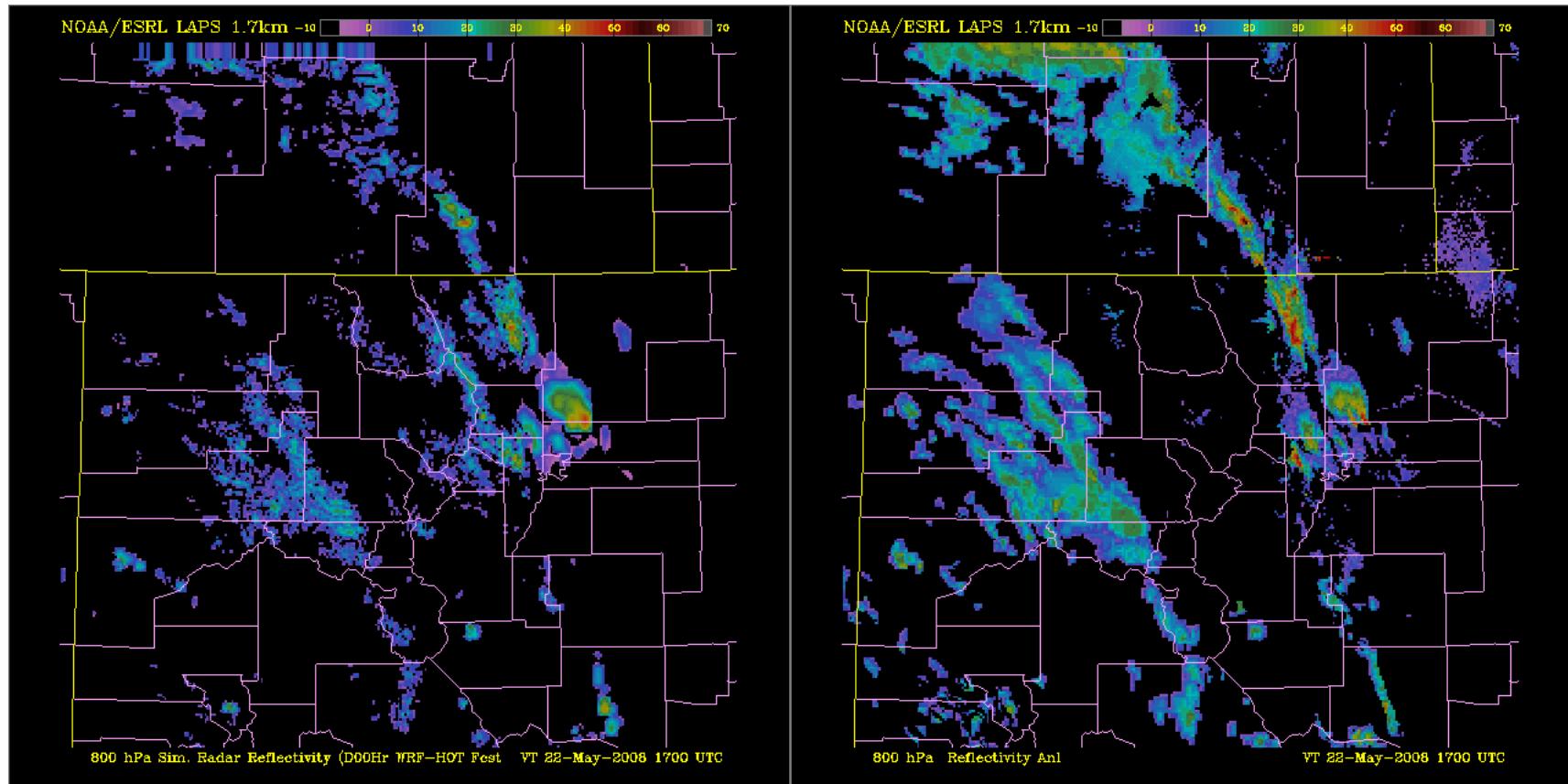


00-03hr simulated reflectivity for 22 May 2005 initialized at 17 UTC

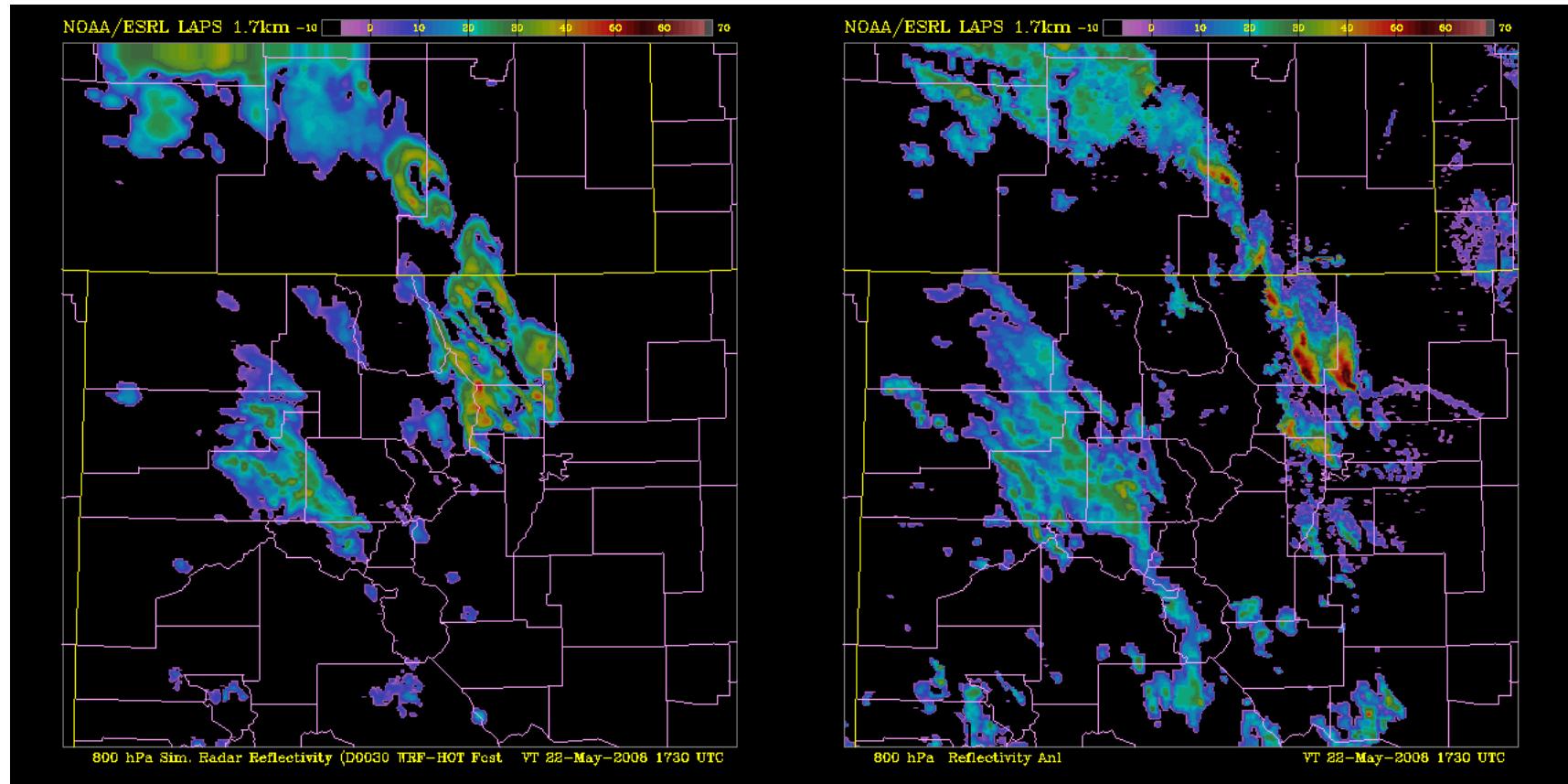


QUESTIONS???

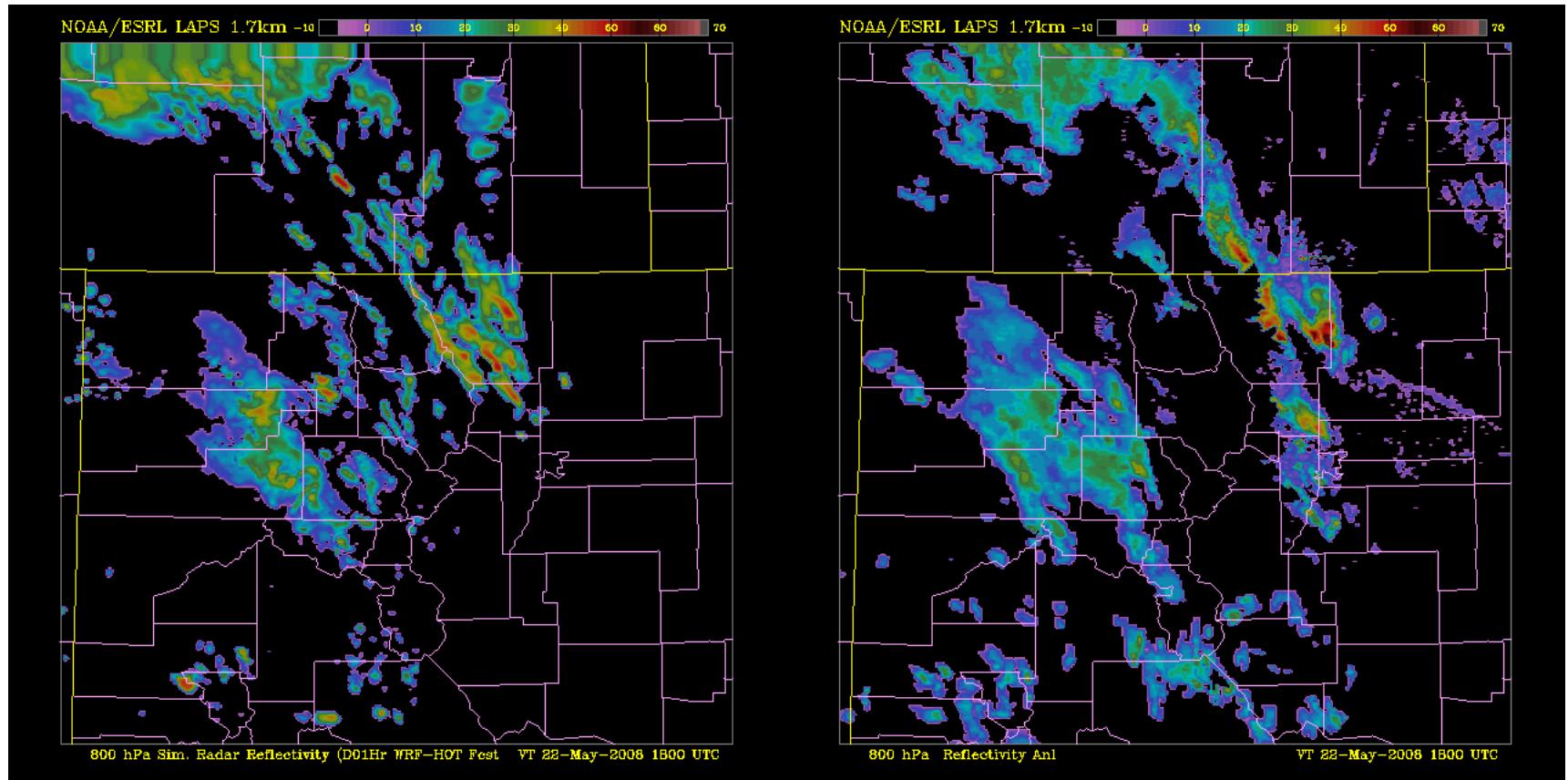
Individual frame for the 17 UTC WRF run 00 hr 00 min



Individual frame for the 17 UTC WRF run 00 hr 30 min

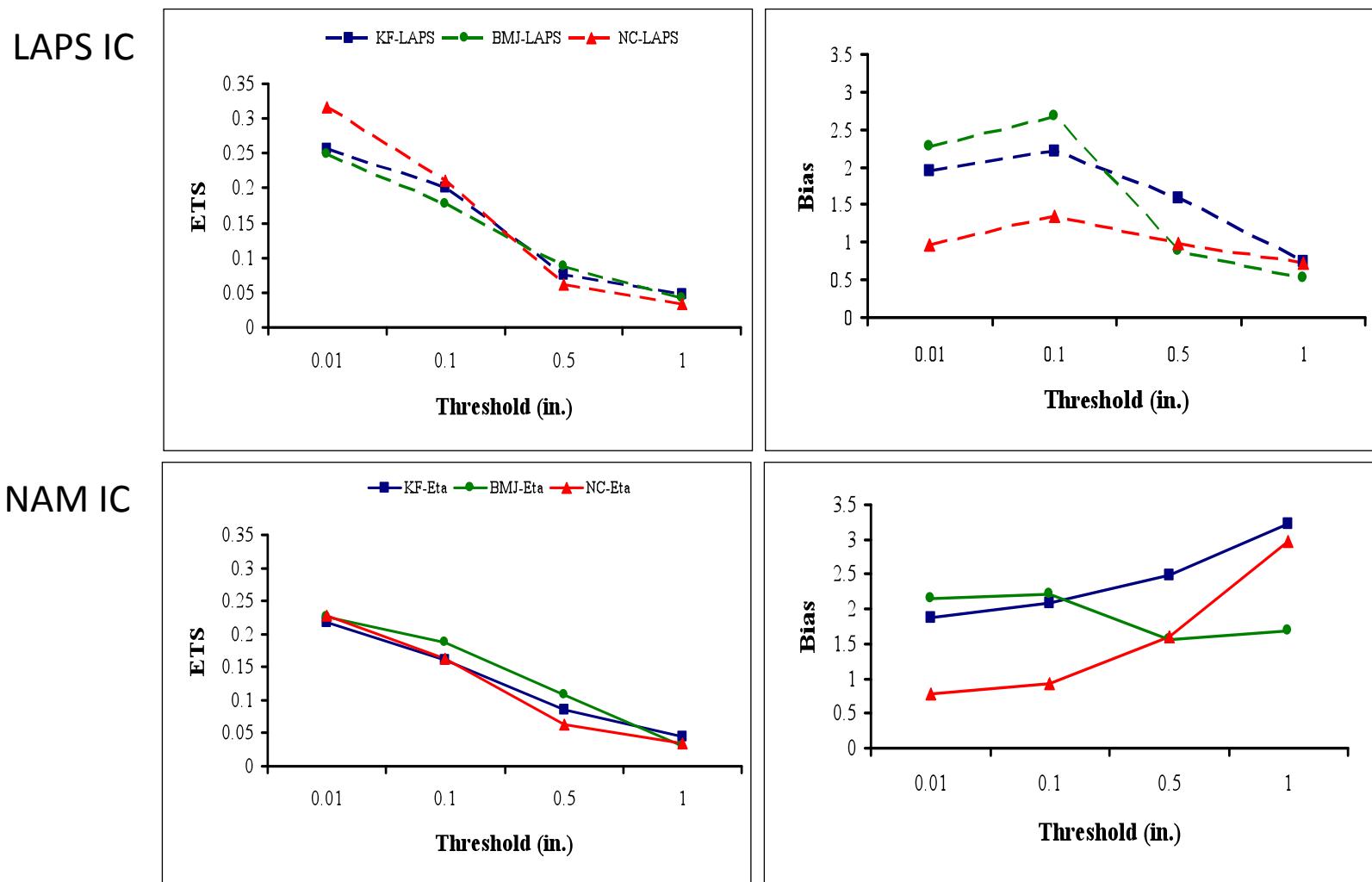


Individual frame for the 17 UTC WRF run 01 hr 00 min



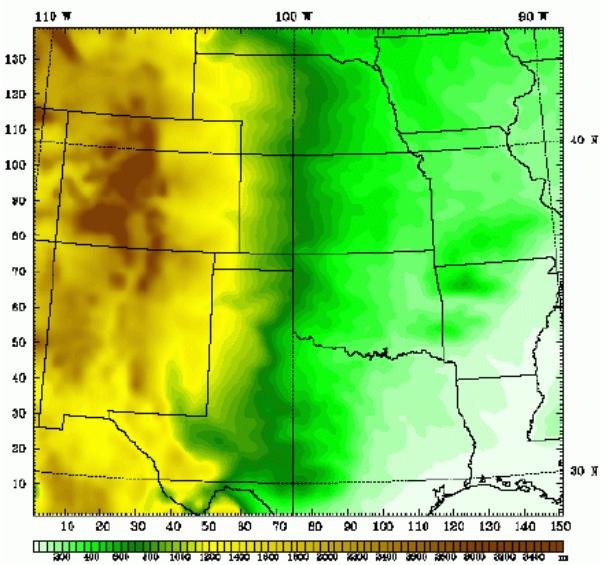
ETS and Bias averaged over 8 events for configurations using various convective parameterizations

00-06h

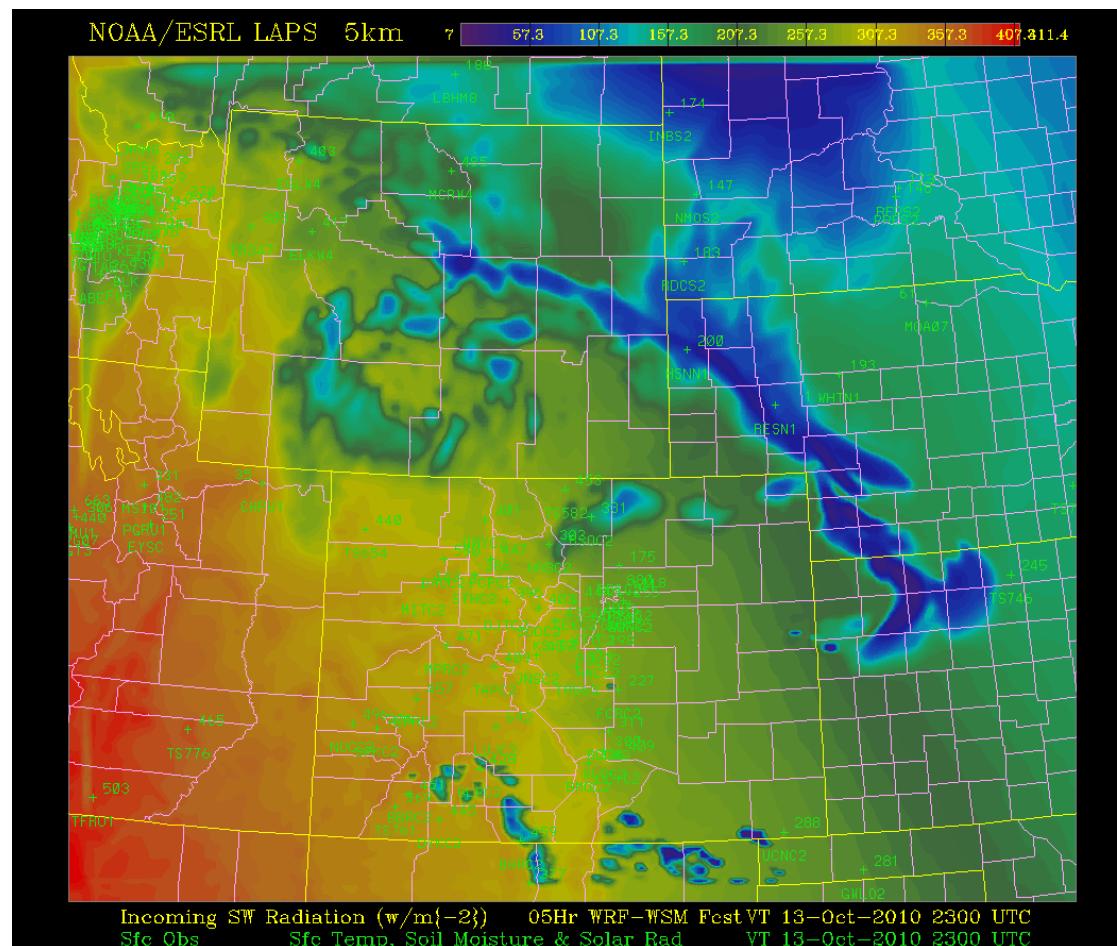


DATA AND METHODOLOGY

- Simulations of 8 International H₂O Project (IHOP) MCS events were performed by using 12 km Weather Research and Forecasting (WRF) model with ARW dynamic core.
- Both diabatic Local Analysis and Prediction System (LAPS) ‘hot’ start and 40km NAM analyses were used as initial conditions, while the boundary conditions were always from 40 km NAM output.
- The simulations were performed for various combinations of Convective, Microphysics and PBL schemes.
- The integrations were performed over the 24 hour period and over a limited domain of approximately 1500x1500 km.

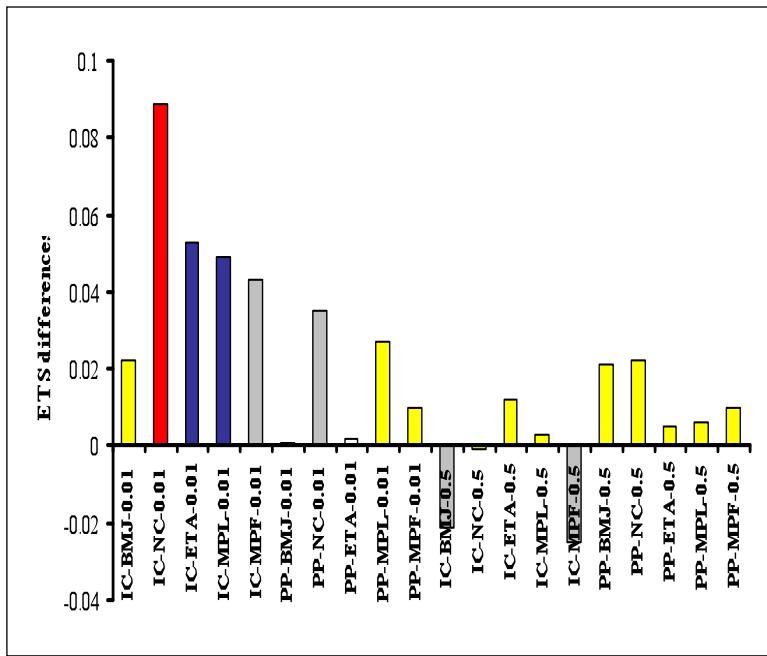


Downward Solar Radiation Fcst. vs. Observations

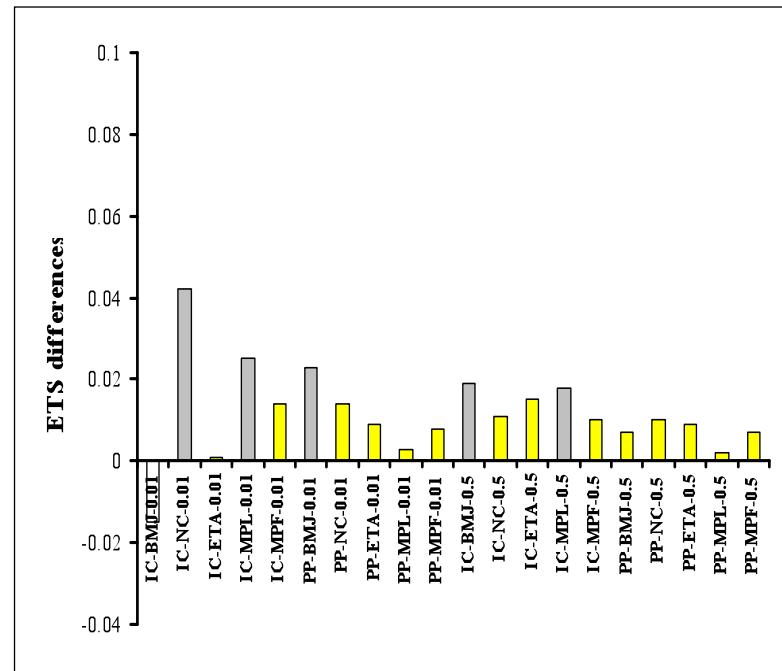


Initial conditions were changed and the model configuration was kept the same

ETS diff. 00-06 hr



ETS diff. 12-18 hr



IC- Initial Conditions (LAPS-Eta)

PP- Physical Parameterization

Red-95%, Dark blue -90%, Grey-80%

Jankov et al. 2007